NOAA IOOS Program
Data Integration Framework Project
Integrated Products Team
Summer Workshop – August 11-12, 2009

EXECUTIVE SUMMARY

The annual NOAA Integrated Ocean Observing System (IOOS) Integrated Products Team (IPT) Summer Workshop was held at the NOAA IOOS Program Office in Silver Spring, MD on August 11 & 12, 2009. The workshop provided an opportunity to inform attendees on current status of IOOS work and for attendees to make recommendations on DIF/DMAC direction in FY2010 and identify technical problems in need of solution.

The workshop was attended by a majority of the IPT, and for the first time included non-NOAA participants including the Environmental Protection Agency, United States Geological Survey, United States Army Corps of Engineers, and United States Navy; IOOS Regional Data Management leads; IOOS Grantee PIs; NSF/OOI-CI; and Unidata. The workshop agenda is in appendix one and full attendees list in appendix two of this report. A more detailed summary of the workshop is found in the following report.

1. **KEY WORKSHOP THEMES**
    - DIF to DMAC expansion
    - Coastal to global connections
    - Client applications and data use
    - SOS implementation issues
    - IPT governance

2. **DIF STATUS**
   The DIF is entering the final year of its three-year risk reduction project lifespan.
    - **DIF overview**: Three NOAA data providers: NDBC (Buoys), CO-OPS (NWLON stations and PORTS®) and CoastWatch (Ocean Color Images) and five IOOS Regional Associations have implemented DIF services. NDBC, CO-OPS and CoastWatch are providing data in the NOAA IOOS DIF format to four customer decision support tools Hurricane Intensity, Coastal Inundation, HABs, and IEAs).
    - Data and Data types used in three of the four customer decision support projects:
        a. Hurricane Intensity: Synthetic Temperature and Salinity Profile data accessed via THREDDS Server/netCDF files provided by AOML
        b. Coastal Inundation: Water Level Observations, Wind Observations, Lowest Astronomical Tide/Highest Astronomical Tide (LAT/HAT) Predictions and Statistical Data (data provider: CO-OPS) and Wind Observations (data provider: NDBC) provided via SOS Web services.
        c. Harmful Algal Blooms: Modeled currents data provided in DIF compliant netCDF format from NOS;s Coast Survey Development Laboratory (CSDL).
    - Three services have been recommended: OGC SOS for in situ/point data, OPeNDAP or OGC WCS for gridded data and OGC WMS to display imagery data.
    - Regional Association Implementation: Five of eleven Regional Associations have implemented at least one DIF services and at least one THREDDS data server is operating in all 11 IOOS Regions.
    - **Customer Application Updates:**

- **Coastal Inundation:** SLOSH Display enhancements have been completed and presently in use by NWS WFO's TPC and the emergency management community.
- **Hurricane Intensity:** Model runs for all three test cases have been completed and will be evaluated to determine value of additional data for hurricane intensity forecast. An evaluation assessment report will be produced by the end calendar year 2009.
- **Harmful Algal Blooms:** Phase two of the Harmful Algal Bloom project has been completed: the results of the transport model runs to determine impact of modeled current data on forecasting the geographical (north/south) extent of a bloom have been evaluated. A final report is due by the end of September 2009.
- **Integrated Ecosystem Assessments:** Update on Environmental Research Division Data Access Protocol (ERDDAP) Enhancements: WMS server, SOS server and SOS client implementations are all 90% complete. Future work will include integration of ERDDAP with NCDDC's Regional Ecosystem Data Management (REDM) application to provide both data search and data access capability.

3. **IDENTIFIED ACTIVITIES AND RECOMMENDATIONS**

- Document best practices; verify and validate DIF implemented services
- Stronger global connection needed. Intersect with GTS data stream. Inclusion of more IOOS data on GTS and better integration of data on GTS into applications.
- Register/ certify data providers;
- Identify next customer application (Ecological/biological; hydrological) – recommend this is a significant item itself.
- SOS Implementation
  - Obtain better understanding of Web services selected for DIF before making additional investments.
    - **Action:** Evaluate value of implementations to customers, usefulness to developers.
  - SOS implementation issues:
    - Differences in services implemented on regional servers.
    - Concern with SOS capability to handle large data responses/fields
  - Improved configuration control and notification procedures
    - **Action:** Include CoastWatch configuration change announcement with SOS Web services configuration change alert message (i.e. email).
- Enable data ingestion by common client applications (e.g. MatLab and ArcGIS)
  - Look for "low hanging fruit" based on needs and readiness of developers/customers
  - Focus on ecological assessment focused applications.
- Registry
  - Registry-type needed for DIF/DMAC needs to be formalized.
  - Identify mandatory metadata fields (at minimum, which fields that cannot be captured at this junction of DIF/DMAC development)
  - Support high level discovery on registry such as Geospatial one-stop.
  - Work more closely with Marine Metadata Interoperability (MMI) to address vocabularies and ontologies
  - Leverage existing or emerging registry (e.g. OOI) if possible
- Metadata

    - Document content required to support all data related capabilities and services and focus on priority services
    - Lead development of tools for translation existing metadata to ISO standard and connect with DIF services
- Archive
    - Work is needed to improve data input to the archive.
    - Make available historical data holdings through SOS Web services and/or other means (OPeNDAP/THREDDS). Improved data access to long-time scale, historical data.
- IOOS Observing Registry: The registry is transitioning operation from NOAA Marine Sanctuaries to the NOAA IOOS Program. No decisions have been made on the future of the registry although it should include federal and other assets.
- Demonstration Tool: an end-to-end data integration demonstration needs to be developed.
- IPT Governance: need increased customer representation; what will be the future IPT construct?

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WORKSHOP REPORT

Purpose: (1) To inform attendees of current status of IOOS work; (2) to obtain strategic recommendations on next steps in FY2010 for customer projects, data providers, additional service types, etc given limited disposal income, existing staff and IPT volunteerism; (3) identify technical problems in need of solution.

Day 1 – August 11, 2009

1. **Welcome, Introductions, Q&A – Zdenka Willis, Director, NOAA IOOS Program**
    a. Collaboration is an essential part of the effort.
    b. Meeting with Dr. Lubchenco in late September - charge is to continue moving forward Science based discussion are taking place in the administration. Two opportunities identified: Marine Spatial Planning and Climate Services; Two Challenges: Satellites and Overfishing. A fifth opportunity is in the area of arctic.
    c. Ocean Task force is looking at ocean governance. Ocean observing aspect will be a key recommendation.

2. **Data Integration Framework (DIF): Present Status**

    a. **DIF Data Provider Status (Jeff DLB/ Rob R.)**
        - Jeff presented an overview of the DIF: Limited-scope, three-year risk reduction project to show value of integration by integrating seven core variables (waves, ocean color, wind, water level, currents, temperature, and salinity) provided by three data providers NDBC (Buoys), CO-OPS (NWLON stations and PORTS®) and CoastWatch (Ocean Color Images) with four customer decision support tools (Hurricane Intensity, Coastal Inundation, HABs, and IEAs).
        - Three services have been recommended: OGC SOS, OPeNDAP or OGC WCS and OGC WMS.
        - Regional Association Implementation: Five of eleven Regional Associations have implemented at least one DIF services and at least one THREDDS data server is operating in all 11 IOOS Regions.

    b. **Testing verification and validation of services**
        - John Ulmer (CSC) has tested NDBC and CO-OPS servers and several regional servers to determine how data interoperability that presently exists at the data provider level. Draft materials have been assembled comparing interoperability before and after DIF implementation at NDBC and CO-OPS. Netcheck is an existing tool that can be used to verify and validate interoperability between data sets.
        - In FY 2010, a formalized approach for testing and validating ocean color will be done.

- To gauge the performance of the system, an on-going, system wide monitoring is needed.

3. DIF Data Provider Implementation

a. Discussion

- Archived data: Efforts are already underway to improve access to data from the archive. It would be beneficial to focus on how to improve data input into the archive.
- Metadata about network of data is minimal:
  - IEAs need long term time-series data sets. Services that can provide local geographical areas have not been addressed.
  - Service Metadata is an aspect that has not been examined, but should.
- Have services (WCS) been implemented in identical fashion at all installations? Implementations may not be identical in all regions because of different configurations required, but the output format is the same. There was disagreement that interoperability actually exists if implementation differs at each regional data provider. It was suggested that configuration change control procedure could mitigate implementation differences.
- Global Component: The global community needs to be more connected with IOOS and IOOS needs to better explain how it relates to the global component. The DIF planning process should include work toward stating more clearly its relationship to the GTS and GODAE Servers and the global standards process. Derrick Snowden asked: What is the "IOOS Standards Process" and how does it connect with other emerging/existing standards processes? How can it be part of the WIS process?
- The GTS is a huge opportunity for IOOS.
- Ben Domenico pointed out that a problem affecting a large population is an ideal topic for a use case. The GTS/WIGOS is an ideal use case for resolving integration from multiple sources. The GTS data stream should be more widely available for public consumption and there should be an effort to feed IOOS data to the GTS that is not already being broadcast.

b. **CoastWatch Report** (Phil Keegstra)

- A THREDDS v.4.0 has been installed and serving data in an operational capacity. The limitations of explicit vs. implicit data conversion were explained with some discussion. A demonstration of implicit conversion from CoastWatch HDF files was described.
- Net CDF libraries have the ability to read multiple data sets. They serve HDF-4 files through HTTP, but cannot serve netCDF files.
- CF conventions are tied to netCDF files rather than HDF formats, which is relevant to the metadata. CF conventions are not relevant per OPeNDAP ("a wire" protocol).
- Phil asked for a decision on how change announcements for CoastWatch protocols should be made. It was agreed in this discussion that conversion change announcements for CoastWatch Ocean Color data should be integrated with the existing SOS implementation change announcement maintained by Jeff DLB.
- Use cases for Ocean Color? HAB-FS for the Gulf of Mexico.

c. IOOS Regional DIF Implementation

- Regional DIF Implementation is being facilitated throughout the 11 IOOS RAs and RCOOSs by the RA regional data leads as part of the coordinated Regional DIF Implementation Team effort.
- Reported status of DIF Implementation: more than 30% of eligible services are operating, 5 of 11 RAs have at least service operating.
- At least one THREDDS server is operating in all 11 IOOS Regions.
- Discussion:
  - If different flavors of SOS are being implemented across the regions – is this a hindrance to interoperability?
  - Accessible client software packages that can consume data is a void that needs to be filled. Perhaps, an end-to-end set of use cases is needed for regional implementation?
  - If IOOS enables a reference library, this will help resolve the client issues.

d. Data Provider Summary:

- Standardized data access services implemented at operational data providers.
  - SOS: profile, time series, collections
  - OPeNDAP/WCS: Regular Grids
- Implementing Detailed Metadata for sensors, platforms, systems
- SOS, WMS, WCS submitted as IOOS Standards
  - Need to document SOS profile for ocean observations
- In planning: Expansion of DIF toward IOOS
  - Service types (Registry, Catalog…)
  - Data types (trajectory, unstructured grid, imagery)
  - Data providers, data customers
  - Connect more closely to global component/WIGOS/WIS (added in real-time during workshop).

4. DIF Customer Projects: Reports on Harmful Algal Bloom Forecast System (HAB-FS), Coastal Inundation (CI), Integrated Ecosystem Assessments (IEAs) and Hurricane Intensity (HI)

a. Harmful Algal Bloom Forecast System (HAB-FS)

- Two phased project to show value for making data interoperable.
  - **Phase 1** – Surface current data from CO-OPS and NDBC were ingested into the existing HAB-FS bulletin software using DIF standards and protocols adopted by the DIF.
  - P**hase 2 –** In this phase, NOS's Coast Survey Development Laboratory (CSDL) model currents data was integrated into a spatial- transport model to enhance the HABs-FS (not currently used in the operational HABS-FS). The model transport runs are complete and the results will be used determine the impact of the modeled current data on forecasting the geographical (north/south) extent of a bloom have been evaluated. A skill assessment report is due by September 30, 2009.

b. Coastal Inundation Project Update: Enhanced SLOSH Display

- In use by NWS WFO's, NWS TPC and Emergency Managers. New additions include graphs and anomaly data overlaid on top of the existing user interface.

- **Discussion:**
  - A challenge has been to coordinate this activity. Configuration management has not been established.
  - Planning strategies, existing models, level of effort need to be documented to reduce duplicity.
  - Coastal Inundation is a nice use case for demonstrating interdisciplinary approaches and illustrates all the issues that come to bear.
  - It was pointed out that SLOSH had been briefed to GCOOS. How can regional products and services use the SLOSH display as a model?

c. **Hurricane Intensity** (Avichal Mehra)

- Overview of the Hurricane Intensity briefed by Avichal Mehra (NCEP). Model runs for the three test cases (Hurricanes Emily, Wilma and Rita) have been completed. He reported that success in improving intensity forecasts was limited, but was better able to determine water mass locations' (significance is location of 26^0 C isotherm) because of this work. More vetting of the process is needed - transition to operations requires upwards of 600 model test runs before use in an operational capacity.
- Importance of DIF stability raised in context of being part of an operational system.
- This test only involved the THREDDS data server.

d. Integrated Ecosystem Assessments (Roy Mendelssohn)

- As part of the Environmental Research Division Data Access Protocol (ERDDAP) enhancements, WMS Server, SOS server, and SOS client implementations are all 90% complete. As part of the IEA project, ERDDAP and REDM will eventually be integrated to provide for both data search via a catalog *and* data access.
- Roy discussed advancing ERDDAP Google gadgets on *iGoogle* as another mechanism for customers to use integrated data.
- Larger question raised – how to get data into applications (e.g. Matlab)? Need to create flow that gets data into the application tool. From an underlying tool perspective, products help enable model development. An agreement is needed on restful request message – the structure of the url "request interface"
- ERDDAP has capability to transform KML files
- ERDDAP is being implemented in a number of the Regional Associations and being used by private users.
- Roy Mendelssohn has been working with Eoin Howlett (ASA/MACOORA) to develop an Environmental Data Connector (EDC) extension that allows users to connect to ERDDAP/THREDDS/OPeNDAP servers using a Java-based browser. The EDC converter data for use in standard GIS analysis tools and displays.

e. **Model Data Interoperability** (Rich Signell)

- Part of the work toward improving model data interoperability has involved development of a tool kit for MatLab – "to make life better for the developer" through improved standards and tool kits. A goal is to bring unstructured grid models to the same level as structured grid models. A tool kit in multiple languages (e.g. Python C) with a Java library would be useful. Also:
  - Need CF standards for unstructured grids

        - Helping/ training has been successful
        - Much of NOAA's success depends on CF standards, but NOAA has not been making an investment in the standard.
        - It was reported that at least one THREDDS data servers have been implemented in each of the eleven IOOS regions.

f. **Ocean Observation Initiative – Cyber-Infrastructure (OOI-CI)** (Matthew Arrott)
    - Matthew provided an overview of the OOI-CI architecture:
        - Work on semantics, use cases, and metadata will make these concepts of the cyber-infrastructure component of OOI a durable and scalable project for the next thirty years.
        - Data models and protocols are to be the enduring components of OOI.
        - The IODM (Internet data distribution Model) is a generalized messaging model that provides for data streaming.
        - Initial phases for OOI-CI will be running 5 prototypes simultaneously. This includes resolving syntactic and semantic interoperability (per John Graybeal's MMI work).
        - Matthew Arrott and Roy Mendelssohn have been working together to bring the ERDDAP tool into the internet "cloud" to test the scalability of this computing environment.

5. Integrated Products Team Working Group Briefs

a. Metadata Working Group (Ted Habermann)
    - Expand contributing portion of the IOOS community
    - Recommendations:
        - Standards: document content required to support all data related capabilities and services
        - Lead development of tools for translating existing metadata to ISO
    - Overview of working group activities – not concerned with discovery – but understanding documentation. Content needs to be represented in simple ways.
    - To encourage collaboration, a page on the GEO-IDE Wiki has been created. The Webpage url: https://www.nosc.noaa.gov/dmc/swg/wiki /index.php?title= IOOS_Metadata_Working_Group
    - It was announced that the North American Profile had been approved. FGDC is not the desired standard in the community.
    - **Discussion:**
        - An effort needs to be done to identify and document metadata content that is required to support all data relevant capabilities and services; and, the content needs to be represented in simple ways.
        - What can be done? IOOS should develop metadata tools.
        - CO-OPS and NDBC with IOOS is writing Sensor Modeling Language (SensorML). SensorML is an important output format.
        - Model metadata and metadata discovery:
        - What about ISO metadata for models? CF conventions? The model community is having detailed discussion per the modeling community.
        - And legacy data and existing metadata? Is it geared mostly for discovery?
        - Are there use cases that demonstrate machine-to-machine or is primarily human-to-machine utilization?

b. **Registry/Catalog** (John Ulmer)

- Is a metadata catalog (in traditional terms) really needed for the DIF? Most important element is understanding the data.
- Use cases for discovery structure would be helpful, if developed.
- Intersects between registry and OOI?
- Need recommendations on mandatory metadata fields or not. At least, which ones cannot possibly be captured at this junction.
- Having a registry list - formal list that satisfies requirements in place.
- Short term & long term drivers should be supporting high level discovery on something like data.gov Geospatial one-stop
- Short-term identify which services
- Write metadata about services that can be found through a Web search engine to access products and services for community at-large
- Idea of registry needs to be formalize – data should be search and findable on a search engine such as Google.
- Certification level: how to define and then set for certain data providers (can ERDDAP "gadgets" play a role here?)
- Prudence needs to be taken in addition of services to the registry that users (e.g. analysts) do not require and will not improve job performance – registry should be customer orientated for customers (e.g. Analysts) that do not want "lists".
- A flexible registry approach was suggested so the tool can be customized. However, schemas need to be consistent enough to achieve interoperability, scalability and synchronicity.
- Lessons learned per the DIF: Need to look carefully before setting up a registry. DIF already presents a good example of the need for standard tools per access to query of the metadata (per recording simple and/or complex items from the data providers/data sets).

6. IOOS Legislation (April Black)

- The legislation creates statute authorization for IOOS to exist. The National Oceanographic Research Leadership Council (NORLC) was named in the act to tie to an existing statute.
- There are questions about the oversight body: Will it be the Interagency Committee on Ocean Science and Resource Management Integration (ICOSRMI) or Interagency Working Group on Ocean Observations (IWGOO)? The System Advisory Committee named in the legislation will advise the NOAA Administrator. There is uncertainty to how this body will evolve or be developed.
- There is civil liability language in the legislation being discussed.
- Certification standards not yet developed. Many questions were raised: What "triggers" a claim? How is a client claim filed? How to file claims against the government? There was not much in the way of resolution because this topic is an ongoing discussion between the IOOS Program and legal experts.
- Other questions asked were if there were any connections to the Climate Services Bill and if the legislation defines DMAC. On the latter questions, the IOOS legislation does not include a clear definition of DMAC.

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Day 2 – August 12, 2009

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7. **Integrated Products Team Working Group Briefs (continued)**

   a. **Archive Presentation (**Ken Casey (NODC))
      - There is a growing movement toward adoption of the Open Archive Information System (OAIS) Reference Model. Conforming to the OAIS Reference Model will structure the way IOOS interacts with the NOAA data centers, non-NOAA archives, CLASS, the DMC and DMIT.
      - Recently, there was passage and *implementation* of the **NOAA** Procedure for Scientific Records Appraisal and Archive Approval.
      - The OAIS-RM provides the ***lingua franca*** – finally we can all talk to one another!
      - The archives are presently holding multiple data set types including underwater video.
      - The decisions for type of data to archive rests on the data center directors. The data has to be evaluated.
      - Per IOOS: how does an IOOS SOA connect to an archive process? The construct is to support science. The archive would provide historical inputs to any data requests by IOOS. A tiered access capability, for categorization and retrieval, is in the future or next steps for the archives process; the capability of creating on demand products, however, is years away.
      - A key role for IOOS is – in the OASIS reference model - as a "designated community" per partnership on ensuring the archive process/protocols are serving the community effectively (i.e. IOOS has roles on the consumer and producer side).
        - IOOS can enable data and data products from the archive to a community of consumers. There are archive activities to unify cross-data center metadata management that will benefit IOOS data at NODC and eventually the tools may be available to IOOS partners to help in their metadata efforts.
        - Looking ahead, NODC will be working directly with NDBC, NODC and the Archive Working Group on evaluating IOOS protocols and the level to which they support archive requirements.
      - The data that is archived should be in the most relevant form. How does the archive fit into the IOOS structure? Consider that the archive would provide historical inputs to any data requests by IOOS.
      - With the emerging OOI/CI work, it was pointed out that OOI/CI had not thought much about archive and there was lots of effort to be put forth in that area.
      - Julie Bosch suggested a demonstration, retrieving data from the archives. IOOS data retrieval is a noted priority IEAs. Ken offered that efforts are already

underway to make data easier to retrieve/ deliver from the archives and proposed IOOS focus on improving entry of data into the archive.
- NOMADS and GHRSST are examples of seamless access to real-time and archival data sets.

8. Grantee Projects (Discussion/Reports)

a. QARTOD to OGC (Q2O) Brief (Julie Bosch)
- The Q2O effort is leveraging the work that has taken place in the QARTOD meetings' series.
- The Q2O effort is an implementation of the QARTOD recommendations for QA/QC using the OGC Sensor Web Enablement framework.
- The Martha's Vineyard Coastal Observatory (MVCO) has been a focus area for applying the Q2O work. A modular approach has been taken by going down to the sensor level. The Q2O works has been accomplished through s series of workshops and in-kind efforts by a group of individuals from around the country.
- To keep moving this forward: the results need to be taken back to QARTOD, work with sensor manufacturers to support QC test development, and plan integration with OOSTethy's cookbook.
- The next QARTOD Workshop is in Atlanta, GA November 17 – 19. The focus will be on the environmental parameter dissolved oxygen and will be held with the Alliance for Coastal Technologies (ACT).
- Discussion points:
  - A key priority for IOOS is integrating metadata. Key here is translations of different representation of metadata. IOOS should join CSML effort rather than use separate schema.
  - Dan Holloway offered that translators could be provided to scope from SOS schema to SCML

b. OPeNDAP – OGC Gateway Project Brief (Dan Holloway)
- The objective of this project is to provide automated capabilities to serve data via interfaces from OPeNDAP.
- Layering of IOOS services through existing OPeNDAP infrastructure will allow for quicker adoption and deployment of the services within community.
- Automation is critical for deployment and long-term maintenance.
- Automation has been a challenge because to be useful beyond a single site a large degree of automation is required in the discovery and exposure of DAP data sets through the OGC service interfaces. An issue with SOS Web Services was brought to the attention of the meeting participants. There are aggregation limitations associated with SOS and lack of concretely defined models within specifications.
- A separate discussion was suggested to talk further and, hopefully, reach agreement on a schema decoder.

c. IOOS Observation Registry (Charly Alexander)
- Funding for the registry is ending and it is expected that the project will be transitioned to the NOAA IOOS Program. It is currently being maintained by the NOAA Marine Sanctuaries Program.

- It is likely the registry will be re-envisioned in the future, but details are still developing.

9. BREAKOUT SESSION ON DIF FY2010: The workshop participants were separated into three groups to discuss candidate priorities for FY2010 DIF activities with present customers. A summary of each breakout session follows.

a. **Breakout Group #1**

- Need to enable data used in ecological assessments.
- Need for a registry of data providers.
- Document best practices: what worked and what did not work.
- Validate and verify SOS Web services employed in the DIF.
- EPA cautioned about trying to accomplish too much and not being able to live up to unrealistic expectations.
- USGS recommended the DIF be validated-verified against other schema and Web services.
- An opportunity is developing to work with Great Lake Data Providers and HAB initiatives as a result of Great Lakes initiative.
- EPA has an application called e-beaches that provide water quality data for America's beaches. The DIF should connect with this application,
- What are the successful elements that have been developed? Tools that are portable, readily available and easy-to-use and already in place. Libraries are needed to support service choice.
- Rich Signell's work on model side has been successful because he is providing a general service. An equivalent service should be developed for in situ data.
- Ted provided perspective that there are two sides of implementation: client and services and that IOOS is somewhere in the middle.
- A key priority for IOOS is integrating metadata. Using SOS Web services to carry metadata separately with other formats – CSML uses the same approach. An issue with SOS carrying metadata is associated volume, which has a negative impact on data transfer speeds. An X-link may be an alternative mechanism to actually carry the data (faster transfer speeds) versus using SOS to transport.

b. Breakout Group #2

- IOOS vs. DMAC Role
- Group recommended to not make further investments into SOS Web services until there is a better understanding of the services that will exist in the larger picture. Consistent schema across communities, tested realistic volume data accesses and accessible through multiple clients.
- Is SOS the only service/protocol making IOOS data available?
- Need to resolve debates about schema problem. Different terminologies/different users. IOOS will always want to support multiple schemas and not limit usage to a single format. It is not reasonable for IOOS the DIF to adopt one schema, but should adopt and support multiple schemas. To have interoperability, there needs to be a base level schema for the community.
- Consistent schemas across communities accessible through multiple meaningful clients (climate reference libraries).

c. **Breakout Group #3**

- Promoting data accessibility – development of a Web-based general purpose viewer.
- Make data accessible to client applications. Use client reference libraries to support service of choices. Portable library/services are a key component. Reference libraries can be used to connect software with GIS and Google Earth applications. The NOAA IOOS Program started a dialog with Google in June 2009. They are pulling data via implemented SOS services; then, converting the data to an internally used format.
- Need clear indication of role of IOOS – boundaries are needed.
- Information sharing tools – The wiki is a reasonable tool to use to exchange information.
- Branding issue – recognition of data sources and protocols needed.
- Demonstration and Testing – a demonstration needs to be produced to show value of integration. Need to perform end-to-end test of the software/hardware and data. It was suggested a tool such as Netcheck could be used to test. IOOS needs to be a leader in a concrete demonstration.

9. IPT GOVERNANCE

a. **Discussion**

- Bill Burnett provided a view of how other IPT's that he has been involved have operated and noted the differences between those teams the DIF IPT (see fig. 1).
- The IPT has oversight of a Mid-Level Council that has the responsibility of answering questions for the IPT.
    - The Mid- Level Council has the authority to create working groups (usually temporary and with a directive to resolve a specific issue).
- Under the current scenario, there were lingering questions about who the IPT was reporting to and answering for.
- Should the DIF IPT be dissolved and reformed under a different construct? There is a need for a stable-active advisory body.
- The DMAC plan provides growth strategies.

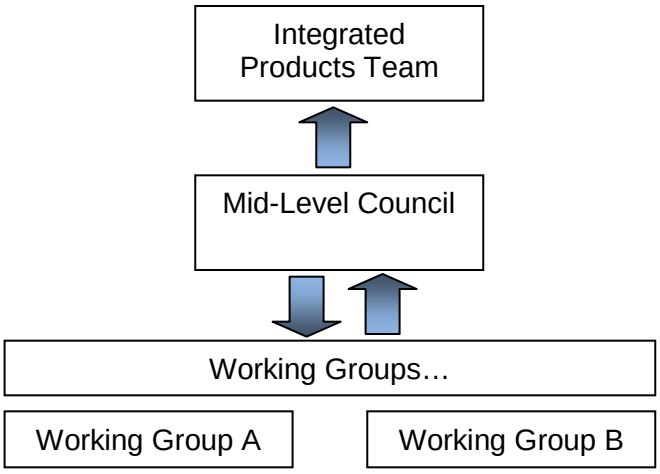

Fig. 1 IPT Graphic based on Bill Burnett's description

b. **Challenges to Governance**

- Increased customer input needed. The IPT does not have sufficient customer representation to provide input on customer needs and requirements.
- Future IPT construct: What construct should a revisioned IPT follow? Is the IPT analogous to the DMAC Steering Team or Expert teams (DMAC ST is not a work team but a recommending body)? Should IPT be viewed as "project managers"? How often should the IPT revise itself?
- **Increased regional involvement**: The IPT moving forward should include more IOOS Regional Association (RAs) and interagency involvement. The RAs now starting installation of the DIF services are powerful advocates for IOOS.
- **IPT test bed development**: move toward a more structured approach to making strategic decisions. Involve client applications, manufacturing and commercial software development.
- **Customer Requirements Assessment Team:** The idea of a customer requirements assessment team was mentioned where 1) a process for identifying and selecting new customers can be developed; 2) Customer requirements can be identified and 3) customer requirements can be satisfied. This team would follow a classic system engineering approach.

c. **Action**: A small work team should be formed to deliberate on this issue and make a recommendation to the full IPT.

10. WRAP UP: In wrap-up, there was a general consensus from the IPT that they did not yet have the guidance needed to develop their activities for the forthcoming fiscal year. There was a real need expressed for coherent data management groups to be formed to guide future discussion.

11. WORKSHOP ADJOURNED

Appendices

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1. **Agenda**
2. **Attendees List**
3. **Presentations**